U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Joinvillea ascendens* ssp. *ascendens*

COMMON NAME: `Ohe

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: August 2005

STATUS/ACTION:

___ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

___ New candidate

__X_ Continuing candidate

___ Non-petitioned

_X__ Petitioned - Date petition received: May 11, 2004

_ 90-day positive - FR date:

_X_ 12-month warranted but precluded - FR date: May 11, 2005

_N_ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions. During the past 12 months, most of our national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (http://endangered.fws.gov).

___ Listing priority change

Former LP: ___

New LP: ___

Date when the species first became a Candidate (as currently defined): 1999

___ Candidate removal: Former LP: __

___ A – Taxon is more abundant or widespread than previously believed or not subject to

the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F – Range is no longer a U.S. territory.

___ I – Insufficient information exists on biological vulnerability and threats to support listing.

___ M – Taxon mistakenly included in past notice of review.

___ N – Taxon does not meet the Act's definition of "species."

___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Joinvilleaceae (Joinvillea family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Kauai, Oahu, Molokai, Maui, and Hawaii

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Kauai, Oahu, Molokai, Maui, and Hawaii

LAND OWNERSHIP: Populations of *Joinvillea ascendens* ssp. *ascendens* are found scattered on State and private lands, with a few also on Federal lands under the jurisdiction of the U.S. Army.

LEAD REGION CONTACT: Paul Phifer, 503-872-2823, paul_phifer@fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, 808-792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION:

Species Description *Joinvillea ascendens* ssp. *ascendens* is an erect herb, 1.5 to 5 meters (m) (5 to 16 feet (ft)) tall. Leaf blades are narrowly elliptic, 45 to 80 centimeters (cm) (18 to 32 inches (in)) long, 4.5 to 16 cm (2 to 6 in) wide. Both leaf surfaces have scattered bristles, with the lower surface also sparsely to moderately pubescent. Tepals in this endemic subspecies usually split with age, the outer ones ovate to orbicular-ovate, 2.7 to 4 millimeters (mm) (0.1 to 0.16 in) long, with a sharp abrupt point to the apex, and inner tepals 2.6 to 3.5 mm (0.1 to 0.14 in) long. Fruit are 4.6 to 5.8 mm (0.18 to 0.2 in) in diameter and the styles are not evident on them (Wagner *et al.* 1999a).

Taxonomy *Joinvillea ascendens* ssp. *ascendens* was described by Brongniart and Gris. This subspecies is recognized as a distinct taxon in Wagner *et al*. (1999a) and Wagner and Herbst (2003), the most recently accepted Hawaiian plant taxonomy.

Habitat *Joinvillea ascendens* ssp. *ascendens* is found in wet *Metrosideros polymorpha* forest

and along intermittent streams, and at elevations between 300 and 1,250 m (985 and 4,100 ft) (Wagner *et al.* 1999a).

Historical and Current Range/Current Status *Joinvillea ascendens* ssp. *ascendens* is known from 50 to 100 populations totaling 100 to 200 individuals on the islands of Kauai, Oahu, Molokai, Maui, and Hawaii (Wagner *et al*. 1999a). Plants are typically found as only one or two individuals, with miles between populations. This subspecies is the only representative of this monotypic species in Hawaii (Bill Garnett, private consultant; Charles Lamoureux, University of Hawaii's Lyon Arboretum; Scott Meidel, Maui Land and Pineapple Company; and Steve Perlman, National Tropical Botanical Garden, pers. comms. 1995 and 1996; Linda Pratt, U.S.G.S. National Biological Discipline, pers. comm. 2005; Ken Wood, National Tropical Botanical Garden, pers. comm. 2005). While we do not know of any surveys or long-term population trends, it is reasonable to assume the populations have continued to decline, since not all of the threats are being managed throughout all of its range.

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range.
This subspecies is threatened by feral pigs (*Sus scrofa*) (B. Garnett, pers. comm. 1996). As early as 1778, European explorers introduced livestock, which became feral, increased in number and range, and caused significant changes to the natural environment of Hawaii. Past and present activities of introduced alien mammals are the primary factor altering and degrading vegetation and habitat on five major islands. Pigs are currently present on five islands, and inhabit rain forests and grasslands. While rooting in the ground in search of the invertebrates and plant material they eat, feral pigs disturb and destroy vegetative cover, trample plants and seedlings, and threaten forest regeneration by damaging seeds and seedlings. They disturb soil and cause erosion, especially on slopes. Alien plant seeds are dispersed on their hooves and coats as well as through their digestive tracts, and the disturbed soil is fertilized by their feces, helping these plants to establish. Feral ungulates trample and eat native vegetation and disturb and open areas. This causes erosion and allows the entry of alien plant species (Smith 1985; Stone 1985; Cuddihy and Stone 1990; Medeiros *et al*. 1986; Scott *et al*. 1986; Smith 1985; Stone 1985;
Tomich 1986; Wagner *et al*. 1999a). Pig exclusion fences protect some of the 50 to 100 known populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

B. Overutilization for commercial, recreational, scientific, or educational purposes.
None known.

C. Disease or predation.
Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Carlquist 1980, Lamoureux 1994). Browsing by ungulates has been observed on many other native species, including common and rare or endangered species (Cuddihy and Stone 1990; Loope *et al*. 1991). Therefore, even though we have no evidence of browsing for this species, it is likely that pigs impact this species directly as

well as their indirect impacts to the surrounding habitat. Pig exclusion fences protect some of the 50 to 100 known populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

Disease is likely a high magnitude and imminent threat because an unknown fungus attacks the seedlings of this subspecies, limiting regeneration. Most known plants do not appear healthy, although the cause is unknown (B. Garnett and C. Lamoureux, pers. comms. 1995). Currently, there is no effectively known control method for this threat.

D. The inadequacy of existing regulatory mechanisms.
Pigs are managed in Hawaii as game animals, but many herds populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers. Pig hunting is allowed on all islands either year-round or during certain months, depending on the area (Hawaii Department of Land and Natural Resources n.d.-a, n.d.-b, n.d.-c). However, public hunting does not adequately control the number of ungulates to eliminate this threat to native plant species. Pig exclusion fences protect some of the 50 to 100 known populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

E. Other natural or manmade factors affecting its continued existence.
Several alien plant species are a threat to this subspecies (S. Perlman and B. Garnett, pers. comms. 1995).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent were introduced from other parts of the world, and nearly 100 species have become pests (Smith 1985; Wagner *et al*. 1999a). Several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al*. 1998) indicate nonnative plant species may outcompete native plants similar to *Joinvillea ascendens* ssp. *ascendens*. Competition may be for space, light, water, or nutrients, or there may be a chemical inhibition of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al.* 1992; Ellshoff *et al.* 1995; Meyer and Florence 1996; Medeiros *et al.* 1997; Loope *et al*. 2004). In particular, alien pest plant species modify habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al*. 1987). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to habitat of *Joinvillea ascendens* ssp. *ascendens*, the Service believes nonnative plant species are a threat to *Joinvillea ascendens* ssp. *ascendens*. The remaining unmanaged populations of *Joinvillea ascendens* ssp. *ascendens* are still impacted by this threat.

Nonnative plants are being controlled in some of the 50 to 100 known populations of this

species, but will probably never be completely eradicated because new propagules are constantly being dispersed into the fenced area from surrounding, unmanaged lands. Many widespread alien taxa cannot be completely eradicated from an island or the State, and therefore are expected to disperse into previously managed areas (Loope 1998, Smith 1985). The remaining populations of the species are still impacted by this threat.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

On Maui, construction of an ungulate exclosure fence in the Kahakuloa Game Management Area, funded through a Service grant to the State Division of Forestry and Wildlife, will protect individuals of *Joinvillea ascendens* ssp. *ascendens* in this area. In addition, the West Maui Watershed Partnership, a non-governmental, non-profit partnership composed of west Maui landowners and managers, received funding from the Service over the last five years for ungulate exclosure fences, which are completed, and ungulate and nonnative plant control, which is ongoing. These actions provide protection to the individuals of *J. ascendens* ssp. *ascendens* in the fenced areas in the west Maui mountains. The East Maui Watershed Partnership, a non-governmental, non-profit partnership composed of east Maui landowners and managers, received funding from the Service in 2005 to continue fencing a 100,000 acre area to exclude feral ungulates and control nonnative plants (University of Hawaii 2005). On the island of Hawaii, the Olaa-Kilauea Partnership has received Service funds (through the Hawaiian Silversword Foundation) to restore native forest to areas previously grazed by cattle within Kulani Correctional Facility. Restoration includes fencing to exclude ungulates, weed control, and propagation and outplanting of native plant components (Olaa-Kilauea Partnership 2005). Hawaii Volcanoes National Park has conducted some outplanting of *Joinvillea ascendens* ssp. *ascendens*, but is having very little success (L. Pratt, pers. comm. 2005). On Oahu, the Koolau Watershed Partnership was provided Service funding in 2005 to fence and remove ungulates from the Helemano area, which will benefit this subspecies once these actions are implemented (Koolau Mountains Watershed Partnership 2005).

This species is represented in *ex situ* collections at Haleakala National Park, Lyon Arboretum Seed Storage Facility, and Volcano Rare Plant Facility (U.S. Fish and Wildlife Service Controlled Propagation Database 2005).

SUMMARY OF THREATS:

The major threats to this taxon are pigs that degrade and destroy habitat, by an unknown fungus, and by nonnative plants that outcompete and displace it, which are believed to be a major cause of the decline of this species throughout its range. Feral pigs have been fenced out of some of the 50 to 100 populations where *Joinvillea ascendens* ssp. *ascendens* currently occurs, but the fences must be continually maintained to prevent incursion. Nonnative plants have been reduced in a few populations that are fenced. These on-going conservation efforts for this species benefit only a few of the 50 to 100 known populations. The species as a whole is still impacted by these threats and will require long-term monitoring and management to maintain threat free areas.

LISTING PRIORITY

THREAT			

Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	2
		Subspecies/population	**3***
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude:

This subspecies is highly threatened by pigs that degrade and destroy habitat, by an unknown fungus, and by nonnative plants that outcompete and displace native plants. Threats to wet forest habitat of *Joinvillea ascendens* ssp. *ascendens* and to individuals of this species occur throughout its range, and are expected to continue or increase without control or eradication. Feral pigs have been fenced out of some of the 50 to 100 populations where *Joinvillea ascendens* ssp. *ascendens* currently occurs, but the fences must be continually maintained to prevent incursion. Nonnative plants have been reduced in a few populations that are fenced. These on-going conservation efforts for this species benefit only a few of the 50 to 100 known populations. The species as a whole is still impacted by these threats and will require long-term monitoring and management to maintain threat free areas.

Imminence:

Threats to *Joinvillea ascendens* ssp. *ascendens* from pigs, fungi, and nonnative plants, are imminent because they are ongoing.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. The subspecies does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. In addition, the Service has provided funding for conservation actions that will benefit *Joinvillea ascendens* ssp. *ascendens*, including construction of ungulate exclosure fences in the Kahakuloa Game Management Area, and for control of nonnative plants, in the west Maui mountains. In addition, the Olaa-Kilauea Partnership and Hawaii Volcanoes National Park are fencing and/or outplanting this species on the island of Hawaii. The Koolau Watershed Partnership is also fencing areas that will protect this speices. If it becomes apparent that the routine listing process

is not sufficient to prevent large losses that may result in this subspecies' extinction, then the emergency rule process for this subspecies will be initiated. We will continue to monitor the status of *J. ascendens* ssp. *ascendens* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING:
Much of the information in this form is based on the results of two meetings of 20 botanical experts held by the Center for Plant Conservation in December 1995 and November 1996, and was updated by personal communication with Bill Garnett, private consultant; the late Charles Lamoureux, University of Hawaii's Lyon Arboretum; Scott Meidel, Maui Land and Pineapple Company; and Steve Perlman, National Tropical Botanical Garden, in 1995 and 1996. We have incorporated additional information on this subspecies from our files and the most recent supplement to the *Manual of the Flowering Plants of Hawaii* (Wagner and Herbst 2003). In 2004 the Pacific Islands office contacted the following species experts: Bob Hobdy, retired from Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Natural Heritage Program; Art Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. No new status or range information was provided in 2004. In 2005 we contacted the species experts listed below and confirmation of the status of *Joinvillea ascendens* ssp. *ascendens* was provided by Linda Pratt, U.S.G.S. Biological Resources Discipline and Ken Wood, National Tropical Botanical Garden.

The Hawaii Natural Heritage Program identified this subspecies as critically imperiled (Hawaii Natural Heritage Program Database 2004). Based on the International Union for Conservation of Nature and Natural Resources Red Plant Data Book rarity categories, this species is recognized as Rare (could be considered at risk) by Wagner *et al*. (1999b).

Species experts have provided new information confirming the status of the species this year and the results are included in this assessment.

COORDINATION WITH STATES:
In October 2004 we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. Vickie Caraway, the State botanist, reviewed the information for this species and provided no additional information or corrections (V. Caraway, pers. comm. 2005).

LITERATURE CITED
List all experts contacted:

Name	Date	Place of Employment
1. Joel Lau	June 28, 2005	Hawaii Natural Heritage Program
2. Art Medeiros	June 28, 2005	U.S.G.S. Biological Resources Discipline
3. Linda Pratt*	June 28, 2005	U.S.G.S. Biological Resources Discipline
4. Rick Warshauer	June 28, 2005	U.S.G.S. Biological Resources Discipline
5. Hank Oppenheimer	June 28, 2005	Maui Land and Pineapple Company

6. Kapua Kawelo	June 28, 2005	U.S. Army
7. Dave Lorence	June 28, 2005	National Tropical Botanical Garden
8. Steve Perlman	March 29, 2005	National Tropical Botanical Garden
9. Ken Wood*	August 2, 2005	National Tropical Botanical Garden
10. Marie Bruegmann	July 13, 2005	U.S. Fish and Wildlife Service
11. Vickie Caraway	June 14, 2005	Hawaii Division of Forestry and Wildlife

*Provided new information on this taxon in 2005

List all databases searched:

Name	Date
1. Hawaii Natural Heritage Program	2004
2. U.S. Fish and Wildlife Service Controlled Propagation Database	2005

Other resources utilized:

Carlquist, S. 1980. Hawaii: A natural history, 2nd edition. Pacific Tropical Botanical Garden, Honolulu. 468 pp.

Center for Biological Diversity, Dr. Jane Goodall, Dr. E.O. Wilson, Dr. Paul Ehrlich, Dr. John Terborgh, Dr. Niles Eldridge, Dr. Thomas Eisner, Dr. Robert Hass, Barbara Kingsolver, Charles Bowden, Martin Sheen, the Xerces Society, and the Biodiversity Conservation Alliance. 2004. Hawaiian Plants: petitions to list as federally endangered species. May 4, 2004.

Cuddihy, L.W., and C.P. Stone. 1990. Alteration of native Hawaiian vegetation; effects of humans, their activities and introductions. Coop. Natl. Park Resources Stud. Unit, Hawaii. 138 pp.

Ellshoff, Z.E., D.E. Gardner, C. Wikler, and C.W. Smith. 1995. Annotated bibliography of the genus *Psidium*, with emphasis on *P. cattleianum* (strawberry guava) and *P. guajava* (common guava), forest weeds in Hawai`i. Cooperative National Park Resources Studies Unit, University of Hawaii. Technical Report 95.

Hawaii, Department of Land and Natural Resources. N.d.-a. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Oahu. Division of Forestry and Wildlife, Honolulu. 2 pp.

Hawaii, Department of Land and Natural Resources. N.d.-b. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Molokai. Division of Forestry and Wildlife, Honolulu. 2 pp.

Hawaii, Department of Land and Natural Resources. N.d.-c. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Maui. Division of Forestry and Wildlife, Honolulu. 2 pp.

Koolau Mountains Watershed Partnership. 2005. Helemano watershed management project, Oahu, Hawaii. Proposal to U.S. Fish and Wildlife Service for 2005 funding.

Lamoureux, C.H. 1994. Conserving Hawaiian biodiversity – the role of Hawaiian botanical gardens. Pp. 55-57. In: C.-I Peng and C.H. Chou (eds.). Biodiversity and Terrestrial Ecosystems. Institute of Botany, Academia Sinica Monograph Series No. 14.

Loope, L.L. 1998. Hawaii and Pacific Islands. Pp. 747-774. In: M.J. Mac, P.A. Opler, C.E. Puckett Haecker, and P.D. Doran (eds.). Status and Trends of the Nation's Biological Resources, Volume 2. U.S. Department of the Interior, U.S. Geological Survey, Reston,

VA.
Loope, L.L., A.C. Medeiros, and B.H. Gagné. 1991. Recovery of Vegetation of a montane bog following protection from feral pig rooting. Coop. Natl. Park Resources Studies Unit, Univ. Hawaii/Manoa, Dept. Of Botany, Tech. Rept. 77.
Loope, L.L. and A.C. Medeiros. 1992. A new and invasive grass on Maui. Newsletter of the Hawaiian Botanical Society 31: 7-8.
Loope, L., F. Starr and K. Starr. 2004. Management and research for protecting endangered Hawaiian plant species from displacement by invasive plants on Maui, Hawaii. Weed Technology 18: 1472-1474.
Maui Pineapple Company, Ltd. 1999. Pu`u Kukui Watershed Management Area, Kahalawai, Maui, Hawai`i, Fiscal Year 1999 Progress Report, Biannual Report. Submitted to the State of Hawai`i Department of Land and Natural Resources Natural Area Partnership Program, January, 1999.
Medeiros, A.C., L.L. Loope, P. Conant and S. McElvaney. 1997. Status, ecology, and management of the invasive plant, *Miconia calvescens* DC (Melastomataceae) in the Hawaiian Islands. Bishop Mus. Occas. Pap. 48: 23-36.
Medeiros, A.C., L.L. Loope, T. Flynn, S.J. Anderson, L.W. Cuddihy, and K.A. Wilson. 1992. Notes on the status of an invasive Australian tree fern (*Cyathea cooperi*) in Hawaiian rain forests. American Fern Journal 82: 27-33.
Medeiros, A.C., Jr., L.L. Loope, and R.A. Holt. 1986. Status of native flowering plant species on the south slope of Haleakala, East Maui, Hawaii. Coop. Natl. Park Resources Stud. Unit, Hawaii, Techn. Rept. 59:1-230.
Olaa-Kilauea Partnership. 2005. Kulani pasture reforestation and habitat enhancement. Proposal funded by U.S. Fish and Wildlife Service Hawaii Community Conservation Initiative in 2005.
Robichaux, R., J. Canfield, F. R. Warshauer, L. Perry, M. Bruegmann, and G. Carr. 1998. Adaptive Radiation. Endangered Species Bulletin. November/December.
Scott, J.M., S. Mountainspring, F.L. Ramsey, and C.B. Kepler. 1986. Forest bird communities of the Hawaiian Islands: Their dynamics, ecology, and conservation. Studies in Avian Biology 9: 1-429. Cooper Ornithological Society, Los Angeles.
Smathers, G.A. and D.E. Gardner. 1978. Stand analysis of an invading firetree (*Myrica faya* Aiton) population, Hawai`i. Proceeding of the Second Conference on Natural Science, Hawaii Volcanoes National Park, pp. 274-288.
Smith, C.W. 1985. Impact of alien plants on Hawai`i's native biota: *in* Stone, C.P., and J.M. Scott (eds.), Hawai`i's Terrestrial Ecosystems: Preservation and Management. Coop. Natl. Park Resources Stud. Unit, Univ. Hawaii, Honolulu, pp. 180-250.
Stone, C.P. 1985. Alien animals in Hawai`i's native ecosystems: toward controlling the adverse effects of introduced vertebrates: *in* Stone, C.P., and J.M. Scott (eds.), Hawai'i's Terrestrial Ecosystems: Preservation and Management. Coop. Natl. Park Resources Stud. Unit, Univ. Hawaii, Honolulu, pp. 251-297.
Tomich, P.Q. 1986. Mammals in Hawai`i: A synopsis and notational bibliography. Bishop Museum Press, Honolulu. 375 pp.
University of Hawaii, Pacific Cooperative Studies Unit. 2005. Threat reduction in the east Maui watershed. Proposal to U.S. Fish and Wildlife Service for 2005 funding.
Vitousek, P.M., C.M. D'Antonio, L.L. Loope, M. Rejnanek, and R. Westerbrooks. 1997.

Introduced species: a significant component of human-caused global change. New Zealand Journal of Ecology 21(1): 1-16.
Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1999a. Manual of the Flowering Plants of Hawai`i, Bishop Mus. Spec. Publ. 97: 1-1918. University of Hawaii Press and Bishop Museum Press, Honolulu.
Wagner, W.L., M.M. Bruegmann, and J.Q.C. Lau. 1999b. Hawaiian vascular plants at risk: 1999. Bishop Mus. Occas. Pap. 60: 1-58.
Wagner, W.L. and D.R. Herbst. 2003. Electronic supplement to the manual of flowering plants of Hawai‘i, version 3.1. December 12, 2003. Available from the Internet. URL: http://rathbun.si.edu/botany/pacificislandbiodiversity/hawaiianflora/supplement.htm.
Wenkam, R. 1969. Kauai and the Park Country of Hawaii. Sierra Club, San Francisco. 160 pp.
Wood, K.R. and S. Perlman. 1997. Maui 14 plant survey final report. Submitted by National Tropical Botanical Garden, October, 1997.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all 12-month petition findings, additions of species to the candidate list, removal of candidate species, and listing priority changes.

Approve: Acting _____ 11/16/05
Regional Director, Fish and Wildlife Service Date

Concur: _____ August 23, 2006
Director, Fish and Wildlife Service Date

Do not concur: _____ _____
Director, Fish and Wildlife Service Date

Date of annual review: September 16, 2005
Conducted by: Marie M. Bruegmann, Pacific Islands FWO
Plant Recovery Coordinator

Comments:
PIFWO Review

Reviewed by: Christa Russell Date: September 23, 2005
Plant Conservation Program Leader

Gina Shultz Date: October 13, 2005
Assistant Field Supervisor,
Endangered Species

Patrick Leonard Date: October 13, 2005
Field Supervisor